REMARKS

The Examiner's action dated December 18, 2003, has been received, and its contents carefully noted.

Claims 1-13 have been amended and are pending.

In response to the rejection of the claims under 35 USC 112, second paragraph, all of the claims have been amended to eliminate the sources of the indefiniteness noted by the Examiner. Accordingly, it requested that this rejection be reconsidered and withdrawn.

In response to the objection to the disclosure, a substitute specification is submitted herewith. In this substitute specification, all of the spelling and typographical errors mentioned by the Examiner have been corrected, as have other errors noted by applicant. It is requested that the objection to the specification be reconsidered and withdrawn.

Similarly, by the present amendment, the spelling error noted in the objection to the claim 13 has been corrected . It is therefore requested that this objection be withdrawn.

The rejection of claims 1, 3, 4, 5, 7 and 13 as anticipated by Perry is respectfully traversed.

The present invention is directed to an armor assembly composed of at least one armor layer intended to be disposed in front of a body that is to be protected. The armor layer is steady and is not supposed to move when the projectile strikes it. The armor layer is constructed to be directly exposed to oncoming firearm projectiles and arranged to divert the projectile from its expected trajectory by being slantingly oriented to the expected projectile trajectory and by being made of lightweight, low fracture toughness and brittle material. It can be assumed that the material, whose mechanical properties are defined by low density, low fracture toughness and brittleness, would also have a relatively low modulus of elasticity and would therefore be potentially prone to failure. In the face of such expectations, it has been unexpectedly observed that such a material is capable of efficiently diverting the projectile from its trajectory and thus of protecting the body located behind the assembly.

Perry discloses a reactive armor construction composed of an outer layer 3, which is rigidly fixed on a protected body 1, and an inner layer 9, which is loosely fixed on

the protected body. The outer layer is directly exposed to a projectile P and is oriented to be at an oblique angle to the projectile. This layer is supposed to be penetrated by the projectile without diverting it from its trajectory. The inner layer, which is not exposed directly to the projectile, is capable of being displaced laterally relative to the outer layer by virtue of momentum associated with the projectile. Movement of the inner layer with respect to the outer layer causes disruption of the line of attack of the projectile, since the action of the layers resembles that of a guillotine. Accordingly the armor construction of Perry does not divert the penetrating projectile from its trajectory in the sense of the present invention, but merely disrupts the line of penetration. The outer and inner layers employed in Perry must be made of strong material in order to function as a guillotine and, not incidentally, Perry explicitly mentions that the layers "in their simplest form may be homogeneous metallic layers, e.g. of armor steel plate" (column 1, lines 63-65). Perry also states, that if the layers are made of composite material, the should comprise "high strength" fibers (column 2, lines 2-5).

In other words, and in contrast to the present invention, the material of the armor construction disclosed in Perry should be strong. If it is made of metallic material, it should inevitably have a high modulus and a high density and its fracture toughness should also be high.

To better distinguish over the reference, claim 1 of the present application now includes features that are in direct contrast to the disclosure of Perry, such as that the at least one armor layer is a lightweight, low fracture toughness, brittle material. Claim 1 now also specifies other features that are absent from Perry, including that the at least one armor layer faces an expected trajectory of the oncoming firearm projectile, said layer being slantingly oriented relative to the expected trajectory of the oncoming firearm projectile. Therefore the present invention, as it is defined in amended claim 1 and the dependent claims, is novel over Perry.

In paragraph 20 of the action, the Examiner asserts that Claims 1-4 and 6-8 are anticipated by Schumacher et al. (GB 2,308,401). This rejection is also traversed.

The bulletproof window disclosed by Schumacher et al. is composed of three laminated window panes 5, 7 and 9, which are spaced apart one from another to form two gaps 6, 8 filled with a fluid. The intermediate pane 7 is positioned obliquely to the adjacent panes 5, 9 and is able to deflect the path of a projectile 4 within the window. It should be borne in mind that only the outer pane 5 is directly exposed to the projectile and this pane is not intended to deflect the projectile but instead to be pierced by it. This pane is not slanted with respect to the projectile. The third pane 9, which is behind the gap 8, is also not slanted. Since each pane consists of two layers, made of bulletproof glass and bonded by a film, one can assume that the panes must have high impact resistance and not be brittle. The whole construction is not intended to divert the projectile from its trajectory but merely to reduce the penetration force by lengthening the distance for the projectile to penetrate the bulletproof window. The object of the arrangement of the intermediate pane at an oblique angle is to deflect the projectile even in the case when it strikes the outermost pane exactly at right angles.

The material of the panes should be transparent, since the invention disclosed in Schumacher et al. is intended to be a window.

In contrast to Schumacher et al., in the present invention the armor layer intended to deflect the projectile is directly exposed to the oncoming projectile. This layer is the sole layer facing the projectile. The present invention does not employ spaced apart layers, which form gaps filled with a fluid. The armor layer is made of a relatively low impact resistance material, which is brittle and has low facture toughness. This armor layer may be made of transparent material, but this is not essential.

Thus, the amended claims, and particularly claim 1, contain features of the armor assemble that are novel over the bulletproof window described in Schumacher et al.

In paragraph 21 of the action, the Examiner asserts that Gosnell (US 3,380,406) anticipates Claims 1-4, 7-8 and 12. This rejection is also traversed for the following reasons.

Gosnell discloses a composite design for transparent armor having a surface that is exposed to high-speed projectiles and is intended to receive their impact. This surface comprises a single member, constituting a layer of an organic high molecular weight

polymeric matrix containing therein a plurality of modulus reinforcing members. The layer of the high, modulus material is at an acute angle to the outer surface of the composite. The high modulus members function to turn the projectile as it strikes without, however, failure of the composite. It is explained in this reference that the turning or tipping motion of the projectile is partially derived from reflection of the shock pressure by the slanted layers of high modulus material (column. l, lines G7-72) and that the high modulus members serve to reinforce the armor material by "increasing its structural, integrity" (column 2, lines 3-5). In other words, the material constituting the armor of Gosnell should be strong enough in order to scatter the shock waves without failure, *i.e.* it should have a combination of high modulus with high fracture toughness. Otherwise, it would be prone to failure and to easy penetration without being able to reflect the shock pressure as required for deflecting the projectile.

In contrast to Gosnell, the armor assembly of the present invention employs low strength, lightweight material that is brittle and has low fracture toughness. This material may be transparent, translucent or opaque. The armor assembly comprises also a rear layer, which can be made of a ductile material. By virtue of this construction, an oncoming projectile penetrating the armor layer and emerging therefrom, either intact or broken up, is deflected either upwardly or downwardly depending on the direction of slant of the armor layer.

The unexpected phenomenon of the present invention lies in the fact that although the armor layer is made of brittle, low fracture toughness material, nevertheless it is still capable of deflecting a striking projectile and does not fail.

By virtue of this deflection, the projectile or the splinters thereof do not penetrate the rear layer. If the armor layer is sufficiently thick, the projectile may be deflected without penetration at all.

Thus the present invention, as defined in the present claims, is novel over Gosnell.

In paragraph 23 of the action, the Examiner asserts that Claims 1-13 are unpatentable over Gosnell (US 3,380,406) in view of Harpell et al. (US 5,362,527). This rejection is also traversed.

The Gosnell reference and its irrelevance to the present invention have been discussed above.

As regards Harpell et al. this reference discloses a flexible, penetration resistant armor 10, which comprises one or more composite layers. One of the layers is a base layer 18 carrying a plurality of planar bodies 26 positioned between two flexible layers 28, 30. The planar bodies are out of contact with each other. The base layer carries, also on its surface, a plurality of planar bodies 24, which are out of contact with each other and which are in misalignment with the planar bodies 26, positioned between the flexible layers. The planar bodies are made of a rigid material and the term "rigid" is intended to include structures that are capable of being free standing without collapsing, in other words they are required to be strong structures. Suitable rigid materials include inorganic materials, such as the metals nickel, manganese, tungsten, aluminum, steel, or ceramics (various single oxides) or organic materials (polymer films, woven and non-woven fabrics, composites and the like). It is clear, that in order to for the armor to be penetration resistant, the planar bodies, made either of metallic or ceramic materials should have high fracture toughness and high modulus. As regards the organic materials, Harpell explicitly states: "useful materials include high modulus thermosetting resins and thermoplastic polymers" (column 19, lines 37-40).

In other words, the armor described in Harpell provides protection on account of improved penetration resistance and **not** as a result of diverting the projectile from its trajectory. This improved penetration resistance is achieved by virtue of materials possessing mechanical properties that render them resistant to failure. Among those properties are high modulus and high fracture toughness. At the same time, by virtue of the specific armor structure disclosed in this reference (flexible layers and a base layer with planar bodies arranged between the flexible layers and on the surface of the base layer), this armor is given a high degree of flexibility even though it includes rigid portions. It should be borne in mind also that the armor of Harpell is not, and should not be, transparent.

In contrast to Harpell, armor assemblies according to the present invention employ lightweight material that is brittle and has low fracture toughness.

Furthermore, exception is taken to the assertion that "Harpell describes a composite with layers, which are in disalignment with sandwiched planar bodies which

corresponds to the plurality of armor elements arranged in a serrated layout". The layers employed in Harpell are **parallel to each other.** Only the planar bodies are in misalignment between themselves, *i.e.* bodies 26 arranged between the flexible layers 28,30 do not overlap the bodies 24, situated on the surface of the base layer. Thus, the layers of Harpell are not similar to the armor layers of the present invention,

Exception is also taken to the assertion in the explanation of the rejection that coated fibers correspond to the impregnated heavy duty cloth material defined in claim 9 of the present application. At column 9, lines 54-58, cited in support of this assertion, it is stated that "layers 28 and 30 may be formed from fibers alone or from fibers coated with a suitable polymer". This description refers to layers made of separate woven fibers, which together constitute a pliable cloth material. In the present application it is indicated that according to the invention there is the possibility of making the armor layer as a composite that constitutes an integral, **hardened** body made from impregnated cloth material.

Exception is further taken to the reliance on column 24, lines 33-36 of Harpell to support the assertion that employment of the coated fabric of Harpell in Gosnell would be motivated with the expectation that "the penetration resistance would be improved". In the cited passage it is stated that the the composites of Harpell can be used in those applications "where flexibility is required and areal coverage by rigid portions are [sic] required to provide some desirable feature but where such portions are not flexible enough to be used as a continuous sheet". Harpell is absolutely silent with respect to the possibility of improving penetration resistance by combining coated flexible fabric with rigid armor. One cannot find either in Harpell or in Gosnell any suggestion that would motivate one skilled in the art to combine their teachings.

It should be also mentioned that a combination of the teachings of Harpell with Gosnell is not possible because in such a combination the intended function of Gosnell would be destroyed. Gosnell discloses transparent armor, while the materials disclosed by Harpell are opaque.

It is further submitted that one cannot, in fact, find in either Harpell or Gosnell any teaching, suggestion or incentive to produce the claimed combination as such, or any

indication that such a combination is desirable or any suggestion for modifying the teachings of either reference in order to create such a combination.

In view of the foregoing, it is submitted that amended Claim 1 is neither anticipated nor obvious to one skilled in the art in light of the cited references, and allowance of claim 1 is therefore respectfully solicited.

Dependent claims 2-13 should alsobe considered allowable at least in view of their dependencies from claim 1.

If the above amendment should not now place the application in condition for allowance, the Examiner is invited to call undersigned counsel to resolve any remaining issues.

Respectfully submitted,

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